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ABSTRACT

After participating in an inservice workshop designed to improve question-asking skills, nine teachers conducted discussion lessons based on science history stories selected from a fourth-grade reading series. Pupils within each class were randomly assigned to one of two groups. One group participated in discussion lessons that involved the extensive use of high level questions by the teacher. The second group's teachers used a preponderance of low level questions. Effects were evaluated using three lesson posttests which measured achievement at six levels of cognition and a measure to determine student attitudes toward the instruction and subject matter. Interpretation of the data analyzed showed it was possible to train teachers to classify and to write questions according to cognitive level using the procedures of the study, and to raise the cognitive level of their class discussions. Analysis of tape recordings produced before and after the workshop supported this conclusion. The different level of questioning did not seem to effect greater student achievement or more positive attitude. (Author/EB)

THE EFFECTS OF TWO DIFFERING QUESTIONING STRATEGIES ON THE ACHIEVEMENT AND ATTITUDES OF ELEMENTARY PUPILS

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INTRODUCTION*

One widely accepted goal of education is the development of thinking abilities in children. Since teachers have used questions for a long time to guide the performance of children, it follows that the use of questions is one of the basic means available to the teacher for stimulating student thinking. The use of questions has been called "by far the most influential single teaching act" (Taba, Levine, and Elzey, 1964). Questions tend to set the expectation climate for pupils and can be used to guide study toward deeper levels of understanding. Students use a teacher's questions to tell them whether they are expected to use higher levels of thought or to repeat facts at the knowledge level.

Considering the widespread use of questions in teaching, it seems reasonable to assume that teachers would have long ago mastered the technique of effective questioning. It would also seem reasonable to expect schools to accomplish the goal of helping students develop intellectual operations such as solving problems effectively, describing phenomena accurately, and analyzing ideas rigorously. Research, however, has shown this not to be the case. Hoetker and Ahlbrand (1969), in a review of studies spanning a half-century, conclude that the dominant mode of thinking stimulated by teacher questions is at the level of memorization and recall of facts and not such higher thought processes as analysis and synthesis.

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There are a number of descriptive studies of teacher questioning practices. An example of this type of study is reported by Gallagher and Aschner (1963), who developed a system for analyzing what they referred to as the quality of thinking in classrooms. While using their system with high ability junior high school classes, Gallagher and Aschner found that teachers' questions most often called for memory and convergence and rarely for divergence and evaluation. In a study involving secondary social studies teachers, Davis and Tinsley (1967) classified teacher questions according to a modification of Bloom's Taxonomy (Bloom, 1956). They too found that teachers stressed the lower levels of thought in their questioning strategies.

From these and other studies and statements (Stevens, 1912; Smith and Meux, 1960; Davis, Morse, Rogers, and Tinsley, 1969), several conclusions may be derived. First, the present research in teacher questioning strategies usually examines the type or level of thinking required of the pupils to answer questions. Teachers' questions are thus classified, using various category systems, from memory (low level) to evaluative or productive thinking (high level). A second conclusion is that teachers emphasize primarily low level questions in their teaching regardless of subject or grade level. A third conclusion reached by many teacher educators is that teachers should change their questioning practices to ask fewer low level questions and to increase their use of higher level questions. Use of high level questions is thought to enhance the development of student thinking ability and thus increase achievement.

There is, however, little empirical evidence concerning the effect of questioning strategies on student achievement and attitudes. Thorough experimental

studies rather than narrative exposition are needed before teacher educators concentrate too much on the development of higher level questioning abilities in teachers. Thus, before all teachers are trained in the use of higher level questions, teacher educators should locate or develop a knowledge base about the effects of various questioning strategies.

The purpose of this experimental study was to determine if teachers trained in question-asking skills could cause greater cognitive achievement and more positive attitudes by using a high level questioning strategy than by using a low level questioning strategy. The high level questioning strategy was operationally defined as a discussion lesson procedure in which at least forty percent of the teacher's verbal questions were above the comprehension level of Bloom's Taxonomy (Bloom, 1956). In lessons using the low level questioning strategy, the teacher's verbal questions were below the application level.

PROCEDURE

The sample consisted of nine elementary teachers and their fourth and fifth grade pupils. Teachers were solicited from the local school system on the basis of their willingness to participate in the study. Four teachers were teaching fourth grade classes and three were teaching fifth grade classes. Two teachers were teaching combined fourth and fifth grade classes.

The participating teacher's preparation consisted of a workshop on question-asking skills for which credit was granted. In the workshop, the teachers studied a self-instructional module entitled Question-Asking Skills for Teachers (Okey, Humphreys, and Bedwell, 1973). The module is a booklet with accompanying audio segments of classroom discussions. Each of the four sections of the booklet provides the learner with practice and feedback concerning particular questioning

skills. Self-tests and answers are also included for each section. The self-instructional exercises in the question-asking module are concerned with classifying written questions according to Bloom's Taxonomy (Bloom, 1956), practice in planning and writing questions according to cognitive levels, wait-time, and sequencing. The learner uses the audio tapes of classroom discussions which accompany the module for practice in using an observation form to classify teacher verbal questions. The learner then plans and teaches several practice lessons. These lessons are recorded and analyzed by the learner using skills developed in the manual.

Before the workshop training sessions began, teachers were asked to begin their preparation by providing a 15-20 minute recording of one of their classroom discussions. This tape served as a record of their questioning skill before instruction.

The analysis of the effectiveness of the workshop training in aiding the development of teacher questioning skills occurred in two ways: (1) by comparing tape recordings produced by the teachers before and after the workshop instruction, and (2) by comparing the results of the module test given before and after the workshop. The module test measures the ability to classify and to write questions according to cognitive level.

The results of this analysis are reported elsewhere (Bedwell and Okey, 1974) and will not be detailed in this report. Briefly, the analysis of the tape recordings revealed significant differences in oral questioning behavior between the tapes recorded before and after the workshop. The analysis also indicated that the nine teachers had significantly improved in their ability to classify and to write questions at all cognitive levels. These conclusions must be considered carefully,

however, because of the lack of a group of teachers for experimental control.

Following the workshop, the participating teachers conducted discussion lessons with their pupils utilizing two different question-asking strategies. This was done to determine the effects of the two question-asking strategies on the attitudes and achievement of elementary pupils. The lessons were based on three stories selected from a fourth grade reading series. The teachers presented the stories in different orders to control for the effect of story sequence on pupil achievement and attitudes. Pupils were asked to read each of the stories silently immediately prior to discussing it.

The pupils within each teacher's class were randomly assigned to one of two groups. Pupils in group 1 participated in discussion lessons which involved the high level strategy defined as forty percent of the teacher's questions above the comprehension level of Bloom's Taxonomy. Pupils in group 2 participated in discussions in which their teachers used a preponderance of knowledge and comprehension level questions. After discussing each story, all pupils were given identical tests prepared by the investigator.

All discussions of each of the stories were tape recorded and analyzed according to the types of questions asked by the teachers. These recordings were used to determine the degree to which each teacher implemented the two questioning strategies.

Two raters coded the tapes of all of the classroom discussions held in the study. The tapes were masked and assigned a random number for identification purposes to eliminate bias in the ratings. The average inter-rater reliability was .82 by simple percent agreement and .74 by using Scott's reliability formula (Scott, 1955). The average intra-rater reliability was found to be .86 by simple

percent agreement and .83 by Scott's formula. Three sample tapes per rater were used in the determination of inter-rater reliability and four were used for intra-rater reliability.

The basic experimental design used in the study was a modified Posttest-Only Control Group Design (Campbell and Stanley, 1963). The design is depicted in Figure 1.

R_1	X_1	O_1	O_2
R_2	X_2	O_1	O_2

R : Elementary pupils within the same fourth or fifth grade class randomly assigned to treatment groups.

X_1: High level questioning strategy.

X_2: Low level questioning strategy.

O_1: Lesson Post-test. The design was repeated over three lessons.

O_2: Student Attitude Measure.

Figure 1. Basic experimental design.

The effects of high and low teacher questioning strategies on pupil achievement and attitudes were evaluated using the three discussion lesson post-tests and the student attitude measure. Results from these four dependent measures were each analyzed by a 2 X 2 (Treatments by Grades) factorial analysis of variance.

RESULTS

Table 1 shows the percentage of high and low level questions used by the nine teachers after their preparation and during the class discussions of each of the three stories. This information was used to determine the degree to which each teacher was able to implement the defined questioning strategies. As can be observed in Table 1, teachers 1, 5, and 6 did not ask at least forty percent of their questions at a level higher than comprehension; therefore, teachers 1, 5, and 6 did not adequately implement the strategies for the purposes of this study. In addition, teachers 3 and 9 found it logistically impossible to meet the experimental schedule. The remaining four teachers (Teachers 2, 4, 7, and 8) were judged to be implementers of the questioning strategies and data from their classes were used in all subsequent analyses.

TABLE 1

Percentages of High and Low Level Questions
Asked by Teachers During Discussions

Teacher	Group	Story One		Story Two		Story Three	
		Low	High	Low	High	Low	High
1	1*	62	38	64	36	82	18
	2**	100	0	100	0	100	0
2	1	11	89	10	90	43	57
	2	96	4	81	19	94	6
3	1			72	28		
	2			100	0		
4	1	36	64	21	79	50	50
	2	100	0	100	0	100	0
5	1	72	28	77	23	69	31
	2	91	9	90	10	100	0
6	1	70	30	69	31	65	35
	2	100	0	100	0	85	15
7	1	42	58	9	91	11	89
	2	95	5	100	0	100	0
8	1	10	90	26	74	36	64
	2	100	0	95	5	93	7
9	1	40	60			52	48
	2	100	0			76	24

*Pupils randomly assigned to participate in class discussions with the teacher using the high level questioning strategy.

**Pupils randomly assigned to participate in class discussions with the teacher using the low level questioning strategy.

Test mean scores and standard deviations for each of the eight subgroups of pupils on each of the three post-tests are presented in Table 2. Although neither the stories nor the post-tests were presented in the same order to each group of pupils, the tests are numbered in the table for ease of presentation.

TABLE 2

Post-test Means and Standard Deviations for the Eight Groups of Pupils

		High Level Questioning Strategy		Low Level Questioning Strategy	
Post-test*	Grade	Mean	S.D.	Mean	S.D.
I	4	3.5	.67	4.3	1.36
		2.6	.98	2.8	.83
	5	3.8	1.34	5.0	1.00
		3.0	1.20	4.8	1.03
II	4	3.0	1.00	3.8	1.40
		3.8	1.11	2.8	1.39
	5	4.1	1.40	4.5	.96
		4.1	1.64	4.7	1.41
III	4	3.9	1.45	3.6	1.19
		1.8	1.03	2.4	1.32
	5	3.7	1.31	3.8	.69
		3.6	1.40	4.1	.99

*Maximum score = 6.00

A factorial analysis of variance was computed on each of the sets of post-test means in Table 2. The results of this analysis are summarized in Table 3.

TABLE 3

Summary of the Analysis of Variance for Post-test Means

Post-test	Source of Variance	df	Mean Square	F
I	Strategies (S)	1	.08	< 1
	Grades (G)	1	2.00	9.52*
	S x G	1	.18	< 1
	Within	4	.21	
II	Strategies (S)	1	2.00	4.28
	Grades (G)	1	1.45	3.09
	S x G	4	.50	1.07
	Within	4	.47	
III	Strategies (S)	1	.10	< 1
	Grades (G)	1	1.53	2.06
	S x G	1	.01	< 1
	Within	4	.74	

*p < .01

The strategy main effect (S) and the interaction effect (S x G) were not statistically significant in any of the analyses. The significant grade level effect (G) occurred on post-test I. Table 3 thus indicates that no consistent patterns of statistically significant relationships are in evidence. The results of an additional analysis revealed that students in grade five scored significantly higher than grade four students on those items which were above the comprehension level.

To determine the affective response to the questioning strategies used in the study, the student attitude measure was administered to all pupils, following discussion of the last story. The resulting mean scores and standard deviations for each of the eight subgroups of pupils are presented in Table 4.

TABLE 4

Student Attitude Measure Means* and Standard Deviations for the Eight Groups of Pupils

	High Level Questioning Strategy		Low Level Questioning Strategy	
	Mean	S.D.	Mean	S.D.
4th Grade Classes	36.8	6.15	36.5	3.33
	35.2	6.55	30.5	7.42
5th Grade Classes	37.8	5.32	38.1	2.73
	38.6	2.92	34.3	4.45

*Maximum score = 45.0

A factorial analysis of variance was computed on the student attitude measure results in Table 4. No significant differences among mean scores were found.

DISCUSSION

The use of high level questioning strategies did not produce greater student achievement than the use of low level strategies in this study. To the contrary, examination of Table 2 reveals a slight trend in favor of the group instructed with the low level questioning strategy. Perhaps the observed trend is due to the cumulative nature of Bloom's Taxonomy (Bloom, 1956). Each of the levels of the Taxonomy builds on the previous level. It seems reasonable that those students who received instruction primarily at the knowledge and comprehension levels were better prepared for a test over all levels because they had established a prerequisite knowledge base. Those students who received instruction primarily at the high levels were perhaps lacking in the basic information needed for success on the post-tests. Other explanations of the observed trend are plausible and additional research is necessary to clarify the nature of such trends.

The attitude measure administered after the instructional unit also revealed no statistically significant differences in the two groups. However, in this case, there was a slight trend toward more positive attitudes in the group which participated in the high level questioning strategy (Table 4). It could be inferred that given more time an affective change perhaps would have been evident.

Although the strategies did not produce significant differences in pupil achievement and attitudes, from the standpoint of teacher education research, it is important to know that teachers can demonstrate operationally defined strategies as four teachers did in this study. In fact, the ability to demonstrate operationally defined strategies is necessary for the completion of process-product studies such as this one. To determine the ultimate effects of a training procedure, research must entail the performance of teacher skills in classrooms.

The results of this study support future use of the question-asking module in training and research involving teachers. By using the module, teachers can be trained to classify and to write questions according to cognitive level and to raise the cognitive level of their class discussions. It was shown in this study that only a minimal amount of training was required in order to significantly improve skills of teachers which involve the cognitive level of their instruction.

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